1987/88
ANNUAL
REPORT

TECHNOLOGY IN ACTION

CORPORATE PROFILE

89-02688/

Nova Scotia Research was established in 1946 by the Province of Nova Scotia to use science and technology to assist in the economic development of Nova Scotia.

Three operating divisions — Applied Science, Industry Services and Product Development — carry out technical assignments for 600 companies and government departments each year.

The Corporation pursues two main goals — assistance to industry in the solution of today's technical problems and product/process innovation in anticipation of tomorrow's opportunities.

While the Corporation serves all sectors of Nova Scotia's industrial economy, it emphasizes technological support for secondary manufacturing industry and takes a special interest in developing Nova Scotia's ocean industry potential.

Applied Science
Technical services and applied R&D for industry and government.

Analytical and Environmental Chemistry
- Lube oil and fuels analysis
- Characterization of metals and organic mixtures
- Pressure-treated wood quality control
- Monitoring asbestos removal
- Indoor air-quality monitoring
- Fish freshness analysis

Biology
- Mycorrhizal fungi R&D to improve growth of coniferous trees and agricultural crops
- Liquid and semi-solid bacterial and fungal fermentations
- Microbiological analysis
- Quality and sanitation surveys of food-handling operations

Coal and Mineral Technology
- Process development and economic studies relating to Nova Scotia's coal resources
- Coal liquefaction R&D
- Spray testing and rheology studies on coal-liquid fuels
- Mineral utilization and industrial waste management

Geophysics
- Marine surveys for geotechnical and geological studies
- Land geophysical surveys
- Borehole geophysical logging
- Data compilation, processing and interpretation

Industry Services
Technical assistance to small and medium-sized manufacturers to improve productivity and technological capabilities.

Field Service
- National Research Council's Industrial Research Assistance Program (IRAP)
- Technical information/literature searches
- In-plant problem solving
- Technology transfer/acquisition
- Technology patent searches

Project Services
- Technical/market analysis
- Fisheries engineering
- Bio resource machine applications engineering
- Mathematics and computer applications
- Glassblowing

Materials
- Mechanical and metallurgical testing
- Welding procedure qualification
- Failure analysis
- Ceramics R&D
- Corrosion R&D

Library
- Computer database searches
- Technical searches

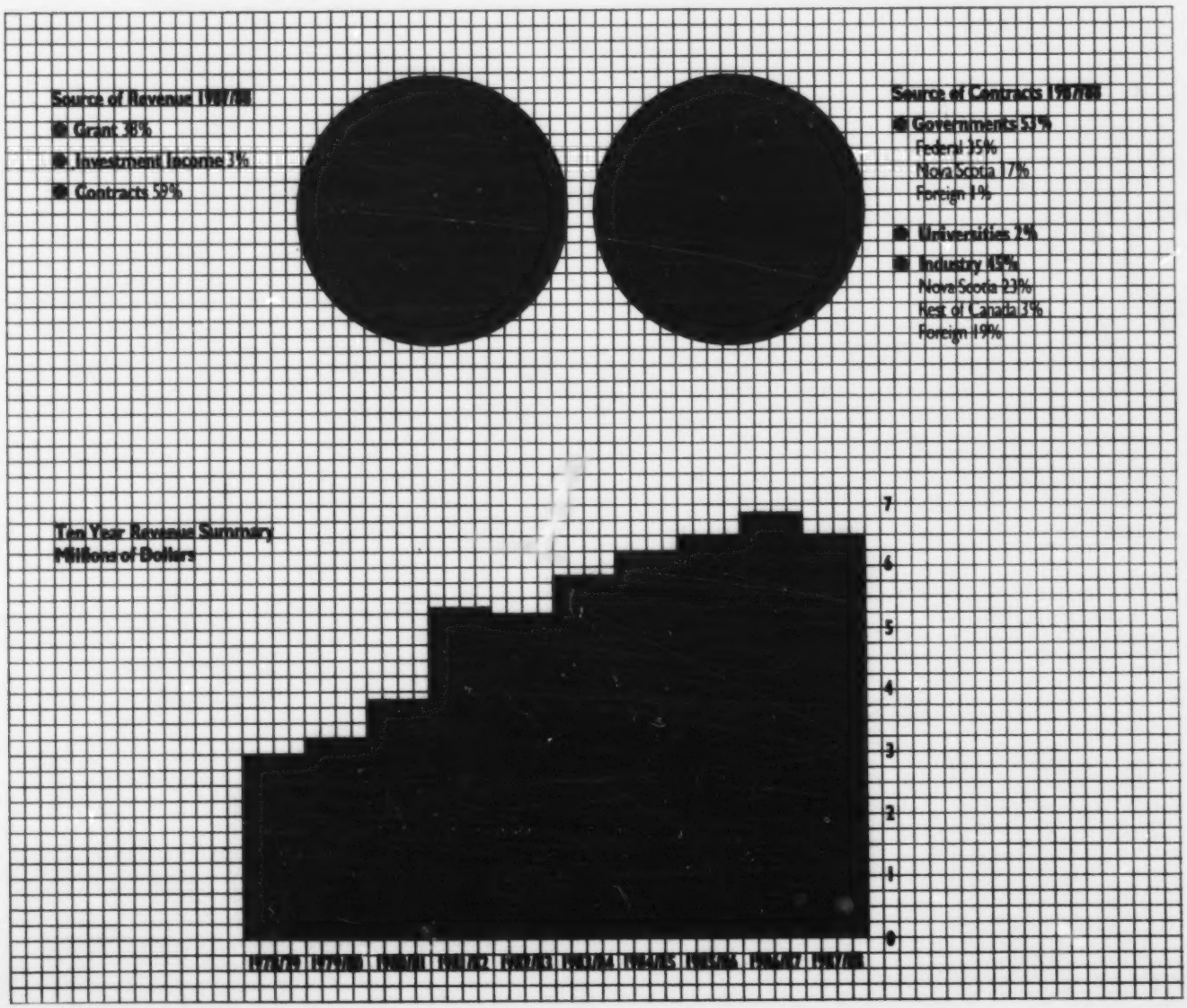
Product Development
Engineering, manufacturing and marketing for:
- New product development
- Mechanical and electronic engineering and design assistance
- CAD/CAM familiarization
- Accident reconstruction

Export sales
Export sales to the worldwide ocean-industry marketplace. Agents and distributors throughout North America and Europe and in Asia and Australia for these NSRFC products:
- Marine electrical slip rings
- Fluid rotary unions
- Diving life-support equipment
- Geophysical marine equipment
- Underwater instrumentation
- Magnetically coupled "zero leakage" blowers and pumps

The Applied Microelectronics Institute
- Provides microelectronics assistance
- A joint venture of NSRFC, Dalhousie University and the Technical University of Nova Scotia

FINANCIAL SUMMARY

	1988	1987
Revenue		
Scientific & Engineering Contracts	$3,840,421	$4,213,852
Grant from Province of Nova Scotia	2,516,900	2,336,000
Investment Income	168,075	190,649
Expenses		
Science and Engineering	5,350,573	5,600,539
Administration & Occupancy	1,161,692	1,162,659
Net Income (Loss)	13,131	(22,697)



PRESIDENT'S REPORT

Statistics indicate that Nova Scotia's overall level of science and technology (S&T) activity is slightly above the national average. What the statistics do not reveal is that the majority of these S&T assets are not closely linked to the economic development process. Federal laboratories and universities account for 86% of Nova Scotia's S&T activity while industry carries out 11%. By comparison, industry across Canada carries out 51% of the total Canadian S&T activity. It is clear that a key element of Nova Scotia's S&T strategy must be to use more of its total S&T resources in support of economic development. The Nova Scotia Research Foundation Corporation recognizes this need and has responded with a number of initiatives in the past year.

Our special capability of transferring technology to a broad spectrum of small industry was strengthened. To our field staff we added a food processing specialist located at Acadia University and a construction industry specialist located in Dartmouth. NSRFC staff made over 1,900 industry visits during the year resulting in over 5,000 technical assignments for 630 industry clients across Nova Scotia. Through the National Research Council's Industrial Research Assistance Program our field engineers arranged for $733,000 in IRAP support for 161 technical projects in industry, a 48% increase over the previous year.

We are enhancing links to institutions with complementary technical skills. Mr. Fraser Sutherland, in the new position of Director of University Liaison, which is assisted by the National Research Council, will seek to initiate joint university/industry/NSRFC programs linking the capabilities of several institutions to address specific technological programs or opportunities. The Corporation has also developed close ties with the new Small Business Technology Centre operated by the Department of Industry, Trade and Technology. I am pleased to note that the new Centre adjacent to NSRFC already houses 17 innovative small companies employing 58 people.

The Corporation has received approval in principle from the Atlantic Canada Opportunities Agency for support of a program to help small companies hire recent graduates to solve technical problems and develop new products/processes. Over the next three years this program is expected to assist 75 new technical positions in small Nova Scotia companies — valuable direct support to the 70% of Nova Scotia manufacturing companies who do not have a scientist or engineer on staff.

Subsequent to the year-end the Corporation completed a licensing agreement with Focal Technologies Inc. of Dartmouth to transfer NSRFC's rotary products technology and product line to the company. From an initial contract for the Bedford Institute of Oceanography NSRFC has, over the years, developed the technology into a line of products that dominate a specialized niche in the worldwide ocean industry marketplace Focal Technologies is well positioned to further develop the product line and address new market opportunities, particularly those associated with a rapidly growing demand for fibre optic systems in marine and military markets. Several NSRFC staff members will move to Focal as part of the technology transfer.

These linkages and technology transfer initiatives complement the Corporation's range of technological activities that are detailed in the Divisional reports. The overall achievements of the Corporation and our services to industry are the result of the dedicated efforts of many talented people. To all members of the staff and Board of Directors of the Corporation my thanks for a job well done. A special word of appreciation to Bryan Rapson, one of our Field Service engineers who retired during the year after a long career with NSRFC.

The Corporation maintained its financial position with a modest net income of $13,000 on revenues of $6,687,000. Reduced levels of offshore oil and gas activity and continued restraint by governments resulted in a slight reduction in the Corporation's overall level of revenues.

A highlight of the Corporation's 40th year was our Open House held in November. Over 500 clients, associates, friends and family joined with us to celebrate 40 years of technological service to the community. A tour of the Corporation's facilities with displays illustrated the many ways NSRFC responds to the technological needs of Nova Scotia industry and government. The very positive response from our visitors has resulted in plans for a future repeat of the event.

In summary, the Corporation has established a number of objectives relating to the need to use more of Nova Scotia's total S&T capability in support of economic development. We have made good progress toward these objectives in the past year and look forward to working closely with our universities, S&T institutions, industry and government to continue to enhance the role of technology as the principle engine of economic growth in Nova Scotia.

T.B. Nickerson, P.Eng.
President

The Honourable Donald Cameron
Minister
Department of Industry,
Trade & Technology
Province of Nova Scotia
Halifax, Nova Scotia

Sir:

I have the honour of submitting the forty-first Annual Report of the Nova Scotia Research Foundation Corporation.

Respectfully yours,

T.B. Nickerson, P.Eng.
President
Nova Scotia Research
Foundation Corporation
Dartmouth, Nova Scotia
November 1, 1988

"The response we have had from the staff of NSRFC on all levels has been superb. To a small company such as ours the assistance we have received from NSRFC has been absolutely vital to our growth."

Gordon F. Jones,
Peninsula Farms Limited

Analytical and Environmental Chemistry

The Analytical Chemistry Section provided technical support to over 275 clients during the year, the majority of whom are small to medium-sized Nova Scotia companies. The Section conducted chemical analyses of a wide range of substances including lubricating oils (accredited by the Standards Council of Canada), fuels, fishmeal, transformer oil and soil analysis for PCBs, process waters, well water, sludges, metals, and pressure-treated wood.

The Environmental Chemistry Section provided technical support to industry and government in the measurement of asbestos in workplace air and insulation materials and of general air quality in offices and urea formaldehyde insulation. Under contract to Acres International Limited the Section is participating in the Sydney Tar Pond Cleanup Program by performing fuel analysis of the Pond's sludge.

Development of a fish quality analyzer continued with financial support from National Sea Products Limited. Field trials were performed at the National Sea Products plant in Lunenburg. The analyzer can determine the freshness of a variety of seafood species including cod, haddock, pollock, ocean perch, scallops, crab and shrimp.

Biology

The Biology Section continued its long-term research program on mycorrhizal fungi which form symbiotic associations with the roots of forest trees and agricultural crops. The investigation for the Canadian Forestry Service of value of mycorrhizae in improving growth and survival of seedlings after outplanting moved beyond the laboratory stage. Seedlings treated with mycorrhizal fungi are being raised and monitored in a local tree nursery.

Under a contract with the Federal Department of Energy, Mines and Resources, the Biology Section conducted a study of cellulase production in two fungi. Cellulase is an enzyme capable of converting the cellulose of waste plant material into sugars which can then be used in fermentation processes to produce liquid or gaseous fuels and other industrial chemicals. This project was part of the current national effort to apply biotechnology toward better use of our natural resources.

Microbiological services for clients in industry and government included examinations for various bacteria, yeasts and molds in water, food products and industrial materials. As interest in preventative and quality-control applications continues to grow, the service gives valuable background aid in problem-solving, as well as conducting sanitation surveys of processing plants and food establishments.

Coal and Mineral Technology

Coal Technology activities focus on new and better uses for coal. Pilot-scale investigations continued on advanced two-stage direct liquefaction of Sydney area coals. Short-term exploratory tests and a fifteen day demonstration run were conducted to evaluate catalyst performance and to determine ultimate hydrocarbon liquid yield and product composition. This work is funded by the Federal Department of Energy, Mines and Resources, the Nova Scotia Department of Mines and Energy and the Canada/Nova Scotia Agreement on Oil Substitution and Conservation.

Extensive test work was carried out on coal-water fuels (CWF) to support the activities of the Cape Breton Development Corporation and Energy, Mines and Resources Canada. The Section examined how altering pump designs affects CWF atomization. In addition, both the type and amount of chemicals used in CWF production were varied in order to examine their effects on atomization.

A preliminary feasibility study on the production of barium chemicals from Cape Breton barite was undertaken for Conwest Exploration Company Limited. The Phase One market analysis and ore beneficiation tests have been completed and the Section is currently concentrating on chemical process evaluations.

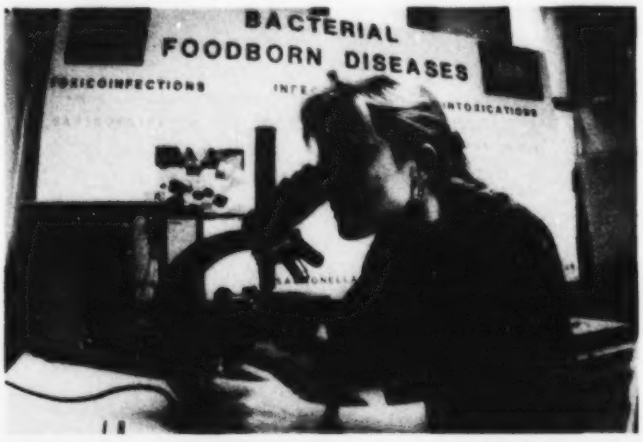
Geophysics

The major activity of the Geophysics Section was the location, acquisition and interpretation of fisheries, bathymetric, bottom roughness, geophysical, geological and engineering data for a preliminary study of an underwater power transmission cable corridor across the Gulf of Maine.

Offshore marine surveys included surficial sediment studies off the eastern shore of Nova Scotia and in the northern Gulf of St. Lawrence. The Section conducted inshore geophysical surveys for dredging studies, bridge construction and harbour improvements in coastal areas of Cape Breton and mainland Nova Scotia.

Borehole logging was carried out for the Northumberland Strait fixed-link crossing study, for the Nova Scotia Department of Mines and Energy Coal Investigation Program, and as a means of determining coal seam thickness and depths. A magnetometer survey detected buried debris in an abandoned dumpsite. Gravity interpretation continued for Nova Scotia sedimentary basins.

Equipment development focused on improvements to our seismic sources, marine streamer repairs and construction of deck cables for the NSRFC Deep Tow Sparker System. A successful *CSS Dawson* test cruise trained personnel in the operation of marine geophysical equipment and acquired new data in Chedabucto Bay and St. George's Bay.



Microbiologist, Kathy Gunn analyzes a food sample for bacterial contamination.

"NSRFC assistance in preparing proposals for the various NRC programs available to us had led to support in each case. Funds and research results from these programs are providing us with a solid footing on which to build our business. NSRFC services are critical to a rapidly expanding industry such as aquaculture."

Paul M. Smith, Fundy Aqua Farms

Field Service

Field Service provides the link between the Foundation laboratories and Nova Scotia industry. The National Research Council's IRAP program helps support eight field engineers and the Province provides funding for an additional one. During the year these field officers, working out of Dartmouth, Truro and Sydney, made 1,700 client visits, answered more than 3,100 queries and carried out 43 industrial engineering or in-depth technical projects. Provincial funding through the Federal/Provincial Technology Transfer Agreement is being used to open an office at Acadia University which will be in full operation during the coming year.

The type of assistance given clients varies considerably but it usually entails technical or plant operations. For instance, an engineer may assist a client with a new plant layout, drawing upon the student program (IRAP-H) to assist in solving equipment and process problems. At the other end of the spectrum, a client may obtain funding under the IRAP program to develop a new product or adopt a new technology. Examples of this type of assistance include development of a new parking meter, a hay compactor or a fish silage process; introduction of computer-based production planning systems; upgrading welding procedures; or aquaculture trials for various scallop species. A client may also be referred to other agencies within the federal and provincial governments.

There is no charge to clients for services provided by the Field Service/IRAP section. The Field Service also assisted more than 150 clients to obtain funding under NRC's financial contribution programs, which resulted in approximately $750,000 of support to help defray the cost of using technical and scientific staff to supplement the services provided by our field engineers and offices.

Our field engineers maintain close contact with the Department of Industry, Trade and Technology (DITT) and the Department of Small Business Development who have services that are needed by our clients. One of our field engineers spends one day each week at the Small Business Technology Centre (SBTC) located adjacent to NSRFC's Dartmouth laboratory.

Project Services

This section was originally started to supplement the Field Service's NRC/IRAP program. Over the years it has acquired other specialties that have enabled it to provide in-depth engineering and marketing assistance to industry, particularly the resource sector. Although some advice is given at no charge to clients, the majority of the work is carried out under contract.

The past year's projects include computer systems assistance to the IRAP program, technical/marketing feasibility studies for coal-based briquettes and fish waste by-products; resource equipment studies on behalf of the Atlantic Farm Mechanization Institute, such as testing of disc-mower conditions and mulching straw spreaders; and for the Nicaraguan government, a redevelopment strategy for shrimp and lobster fisheries.

The Project Services Group also includes the NSRFC Glass Blowing lab which provides custom glass blowing and repair services in support of labs throughout NSRFC and on a fee-for-service basis to scientific and industrial clients throughout Atlantic Canada.

Materials

The Materials Section was established to help industry solve material problems and utilize new developments in materials science. During the past year these activities included materials research and development; failure analysis; and mechanical testing of various types, including tensile, bend and impact testing. Fracture toughness, fatigue testing and corrosion testing have been carried out in various environmental conditions. In addition we have undertaken work on plastics and various types of fibre-reinforced plastics.

The section is participating in the "Space Station User Development Program" to develop a novel process for the production of unisize submicron ceramic powders. Additional activity includes the production of structural ceramic parts. One of the most interesting new projects is the underwater explosive bulge testing of submarine hull plates, a capability unique in Canada.

Our forensic metallurgy activity has increased to serve lawyers, insurance firms and other consulting groups requiring our specialized capabilities. This service is provided in conjunction with other sections of NSRFC.

One of our engineers, in cooperation with IRAP and the Centre de Recherche Industriel du Québec, visited four Nova Scotia foundries to evaluate their processes and to offer recommendations for improvements.

Library

The library provides an information resource, not only to the Division but to the Foundation as a whole, and is also available to the technical public. The current collection of approximately 20,000 volumes of books, journals and reports is enhanced by interlibrary loan cooperation with other libraries. In addition, eight on-line systems provide access to over 400 databases.

Divisional Vice-President John Helliwell and metallurgical engineer Terezia Betancourt confer on a client project.

"We used NSRFC as our engineering and development laboratory. This resulted in a successful and profitable new product for our company. We plan to use NSRFC in this role on an ongoing basis as it enables us to undertake innovation and development with a minimum of internal overhead."

Robert Wilson, The CORD Group Limited

The Product Development Division operates as a small, ocean-technology-related design, development and manufacturing company whose range of products is primarily for export. The Division uses its experience to provide specific design, development and CAD/CAM/CAE services to Nova Scotia industry.

Sales of our rotary products (electrical slip rings, fluid rotary unions and fibre optic rotary joints) were slow early in the year; however, they turned strongly upward near year-end, signalling a significant turnaround in the international offshore market. This manufacturing activity is now worthy of spin-off to the private sector; after year-end the NSRFC reached a licensing agreement with Focal Technologies Inc. of Dartmouth as detailed in the President's Report.

Engineering

CAD/CAM implementation continued throughout the year. More emphasis was placed on microcomputer-based CAD/CAM systems. The mainframe and microcomputer systems were linked through the Initial Graphics Exchange Specification (IGES) interface which allows designs developed on either system to be transferred to the other. These technologies are applied to the Corporation's own design/marketing/manufacturing activities, and the resulting skills and experience are used to assist industry throughout the Province.

The fibre optic rotary joint (FORJ) development continued with the introduction of an updated multi-pass design, plus a new single-pass design which has potential for single-mode application. A United States patent was awarded for the multi-pass FORJ. The FORJ capability has enhanced the sales of electrical slip rings; combination units were sold to the U.S. Navy, R.O.V. companies and a U.S. aerospace company.

The development of our traditional rotary products continued with emphasis on cost reduction and design rationalization to make these products more suitable for licensing to private industry.

Magnetic couplings were used in two major projects. A magnetically coupled hydrofluoric acid process pump was developed for oil-refinery application. This pump used a modified off-the-shelf design which incorporated new bearings and our magnetic coupling. As well, we designed a zero thrust blower from the ground up for use in a 10,000 psi autoclave. Both of these products have further commercial applications.

Small engineering contracts consisted mainly of IRAP-supported design work and subcontract mechanical design for the Applied Microelectronics Institute. Our CAD/CAM capability enhances this type of work.

Forensic science and engineering services to the legal and insurance sector increased considerably throughout the year. These services include traffic accident reconstruction and chemical and metallurgical analysis.

Marketing

This year we expanded our market exposure by engaging representation for the first time in Japan. As well, the Corporation exhibited at trade shows in Washington, Orlando and Brighton. We continue to be represented in Western Canada; California, the Gulf Coast, New England and the eastern United States; the United Kingdom; Norway; Denmark and Sweden; Holland; West Germany; France; Belgium; Singapore; and Australia.

Manufacturing

The Manufacturing Group is responsible for assembly, production control, quality control and manufacture of parts. Diversity of product and a new use of existing products by the U.S. military have tended to spread the product requirement more evenly throughout the year.

The increased use of fibre optic rotary joints in combination with our electrical slip rings has increased our work load of prototype and pre-production units. In addition, a small volume of units were manufactured for oceanographers and users of underwater trenching equipment where very good quality video was required.

Use of CAD/CAM during the year improved our productivity significantly and resulted in an upgrading of staff skills.

Quality Assurance

Quality Assurance maintains consistent high standards of quality for the ever-changing products of the division. The guidelines of the quality program have been accepted by national agencies as well as by numerous customers and companies at all levels in the marketplace. A number of Nova Scotia firms have reviewed this program as a model for their operations.

Tom Nickerson, (centre), presents patent plaques to NSRFC inventors John Oliver, Pat Taiani, Gerry Lutwick and Ed Smallhorn.

"No longer hiding our lamp under a bushel."

The Nova Scotia Research Foundation Corporation (NSRFC) has kept a low profile over the past 40 years as it continues to sponsor advances in science and technology, but now it has ceased "hiding its lamp under a bushel," says president Tom Nickerson.

The corporation, located in south Dartmouth, held its first open house Tuesday, attracting about 500 people including clients in the private sector, family and friends, as well as members of the general public.

"We are looking more now to increase public awareness as to what we are doing. Before, the people who did business with us knew us. That was fine for a while, but it's not anymore," Bob MacNeill, vice president in charge of finance and administration said.

The NSRFC, founded by the provincial government in 1946, has been located in its Dartmouth facility since 1969. It employs about 120 people, including scientists, engineers, technicians and support staff, whose mandate it is to assist local industry in solving technical problems and in increasing its competitiveness on the world market.

"We are not trying to compete with the consultants. We are just trying to help the smaller guy along until he can pay his own way," says Mr. MacNeill.

The corporation's three operating divisions — applied science, industry services, and product development — carry out technical assignments for 600 companies and government departments each year.

Developing a strong home grown science and technology industry is a must to survive in the competitive age becoming increasingly dependent on high-tech. Canada spends only 1.3 per cent of its gross national product on research and development — about one half of the amount spent by all of its major trading partners, says Mr. Nickerson.

This is part of the reason Canada has a trade deficit reaching in the billions of dollars for high-tech products it has no choice but to import, he said.

Nova Scotia, however, is in "good shape as far as high tech development is concerned," says Mr. MacNeill.

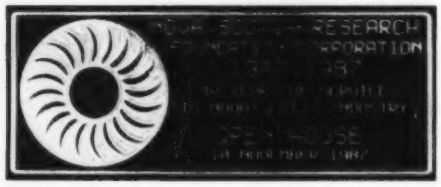
"We are not behind anyone and we have nothing to be ashamed of."

He said he hopes an enhanced public awareness of NSRFC's role will complement the work of the corporation's field services officers, and encourage more companies to turn to it for technical help.

He said the corporation will hold more open houses in the future, because it is important the public understand the need for high-tech development.

"Science and technology. People use the words a lot, but they don't know what it all entails," he said.

Unique N



Glass blower, Ray Maxwell, demonstrates his skills.

Little known, but it has worldwide sales

There's a little-known Crown corporation in Dartmouth that is involved in everything from parking meters to magnetically run pumps for hazardous liquids and gases to advances in making liquid coal.

Nova Scotia Rese... Corp...

The parking meters are a top-secret project which MacNeill can't talk about. But just wait, because they'll be a hot item, he promises.

"One of our problems is that ... not well known," he said, "...ducts are important ... work ...

leakage. Most pumps work at 300 to 400 horse power, he said, but the hyperbaric blower ... use 1,000 hp because th... friction to cause ...

It is use... t...

substa...

Research firm keeps pace with tech

...hard for the small ... keep up with ... tech-

science and technology to assist in the econonmic development of Nova Scotia."

The corporation has ...blished a special relationship ... businesses. Sixty ... ...tele employs ... people an...

"We don't do research just for the sake of knowledge, we provide services directly needed by industry."

The cor... ration is inv...

tion that lost human body ... insul...

S. designed mannequin

NSRFC opens cad/cam centre

A new $1.35-million centre has ... ...merging tech-

sign is perfect, the engineer can direct the computer to dri... ...ne

the recently established small business technology cent... ...edside Oce...

Cooperation: Key to commercializing

The development of the CORD Group's Thermal Manikin Test System illus... tion were ... ...

Technical officer, Floyd Smith explains geophysical data to open house guest, Leigh Beauchamp. NS CAD/CAM Centre.

Atlantic Institute of Biotechnology (AIB)

The Atlantic Institute of Biotechnology is an independent, federally-incorporated non-profit research institute jointly sponsored by Dalhousie University, the Technical University of Nova Scotia, the Nova Scotia Research Foundation Corporation and the Nova Scotia Agricultural College.

AIB staff are experts in business analysis, marketing and R&D management. Assistance can be financial as well as scientific and technological. R&D projects focus on specific industrial objectives and are directed and controlled normally by personnel from the client company.

Projects may be carried out within the company or, where required, access can be arranged to facilities and expertise of research organizations or universities in the region. The Institute has established a comprehensive inventory of research capabilities that can be made available for industrial tasks in the Atlantic region.

During the past year AIB has been involved in thirteen research projects in the fields of agriculture, horticulture, aquaculture and health care such as micropropagation of plants, aquaculture of scallops and hybridonia research related to the development of diagnostics.

Atlantic Farm Mechanization Institute

The Atlantic Farm Mechanization Institute (AFMI) was created as a non-profit corporation in 1985 to carry out research, development and testing of agriculture and woodlot machinery in and for Atlantic Canada.

The Institute is administered by a Board of Directors made up of farmers, extension agricultural engineers and representatives of the farm machinery industry. An "institute without walls," AFMI carries out its activities by drawing together expertise and resources in various institutions and firms within the region.

Managed by the Nova Scotia Research Foundation Corporation under the direction of the Institute's Board of Directors, the Institute carries out specific projects on a contract basis for individual clients and agencies.

This year's projects included the design of equipment for processing fresh blueberries, fiddleheads and vegetable salads; as well as field testing and evaluation of disc mower conditioners and mulching straw spreaders.

National Research Council Canada (NRCC)

The Industrial Research Assistance Program (IRAP) is an NRCC program delivered to industry across Canada through a network of field offices. These field offices are set up by NRCC and many other affiliated organizations such as the Provincial Research Organizations, universities, the Association of Consulting Engineers of Canada, the Construction Association of Canada and the Royal Architects Institute of Canada. In Nova Scotia eight of twelve industrial technology advisors are Nova Scotia Research Foundation Corporation staff.

NRCC provides funding to cover all of the direct people costs involved in providing these programs as well as a portion of the associated overhead costs. Nova Scotia Research provides the facilities and the remainder of the overhead costs associated with the program. All of the R&D funding delivered to industry in the Province through the program comes from NRCC. In 1987/88 approximately 200 projects received IRAP contributions totalling more than $1.5 million.

Over the past few years the IRAP network has grown considerably and continues to expand. The latest expansion has been into the construction industry. Nova Scotia Research now has one technology advisor who specializes in construction and there will be soon two additional advisors dedicated to the industry, but attached to other organizations.

What began as the NRCC Technical Information Program more than thirty years ago has grown into a multi-disciplined national network of technology advisors. This diversified group now provides technical and engineering advice, technology transfer and innovation assistance, research and development program organization and financial support to assist with these activities.

The IRAP Program has become well recognized as a shining example of effectively using taxpayers' dollars to stimulate technological development in Canada. The cost benefits of the program are outstanding and well-documented. Nova Scotia Research is very pleased to be a significant player in delivering IRAP to industry in Nova Scotia.

Applied Microelectronics Institute.

Founded jointly in 1981 by NSRFC, Dalhousie University and the Technical University of Nova Scotia, the Applied Microelectronics Institute is now autonomous and financially self-supporting.

In 1987-88 revenue of over $1 million placed AMI in a surplus position. Contract services generated approximately 80% of this revenue. AMI serves over 40 clients in projects that have varied from basic specialized consumer products to sophisticated systems that integrate hardware development with real-time software design. This area will continue to be a focus of technical activity for AMI.

Midway through its five-year plan, AMI is achieving its goal of maintaining leadership in the application of advanced electronic engineering design techniques. Future advances will include the application of integrated circuit design and other semi-custom logic devices.

There has been a progressive integration of activities with the Nova Scotia Research Foundation, for which AMI provides sophisticated electronic design. AMI's facilities are utilized for NSRFC staff assignments and training as well as under direct contract. AMI also uses NSRFC facilities. This collaborative effort is expected to develop over the coming year as the requirements for sophisticated electronics by NSRFC increases and the capabilities of AMI are utilized more extensively.

PAPERS, PUBLICATIONS AND PATENTS

Betancourt, T.
"Statistical Behaviour of Fatigue Crack Growth in HY-80 Steel Plate and its Weldments Under Cathodic Protection", presented at the 2nd Canadian Forces/CRAD Meeting on Research in Fabrication and Inspection of Submarine Pressure Hulls, DREA, Dartmouth, NS, May 1987.

Betancourt, T., Matthews, J.R.
"Effect of Data Averaging Increment on Variability in da/dN Data," published in the *Journal of Testing and Evaluation*, Vol. 16, 1987.

Boyle, C.D.; Robertson, W.J.; Brown, H.L.
"Mycelial Suspensions as Ectomycorrhizal Inoculum", presented at the 7th North American Conference on Mycorrhizae, Gainesville, Florida, May 1987.

Oliver, J.B.; Smith G.; Purdy, J.
"Fibre Optic Rotational Interfaces", presented at Oceans' 87, Halifax, NS, September-October, 1987.

Oliver, J.B.; Spencer, W.W.
"Fibre Optic Rotary Joints" presented at the IEEE Canadian Atlantic Spring Seminar — Optics in Engineering, March 1988.

Oliver, J.B.; Spencer, W.W.
Awarded U.S. patent for "Multiple-Pass Optical Rotary Joints" (Rights assigned to NSRFC).

Robertson, W.J.; Boyle, C.D.; Brown, H.L.
"Mycorrhizal Status Of Certified Strawberry Stock From Nova Scotia", presented at the 7th North American Conference on Mycorrhizae, Gainesville, Florida, May 1987.

Robicheau, M.
"Mechanical Characterization of Glass-Reinforced Plastics", presented at GRP Fire-Resistance Workshop held at DREA, Dartmouth, NS, January 26, 1988.

Starzomski, J.J.; Jay, D.M.
"Two-Stage Liquefaction of Nova Scotia Bituminous Coals" presented at the 37th Canadian Engineering Conference, Montreal, Quebec, May 1987.

Thambimuthu, K.V.; Stover, N.S.H.; Whaley, H.
"The Mechanism of Atomization of Coal-Water Mixtures", presented at the 3rd European Conference on Coal Liquid Mixtures, Malmo, Sweden, October 1987.

Thorpe, J.W.; Hellenbrand, K.
"Microbial Degradation of Hydrocarbon Mixtures In A Marine Sediment Under Different Temperature Regimes", Environmental Studies Research Funds, Report No. 083, September 1987.

Thorpe, J.W.
Presented a bnef to the Provincial Task Force on Hazardous Waste Management.

NSRFC IN THE COMMUNITY

Archibald, G.
Committee Member and Treasurer of Science & Technology: A Job Creator Conference, Halifax, NS, June 1987

Secretary of the Association of Professional Engineers of Nova Scotia Finance Committee

Betancourt, T.
Mentor for Engineers-In-Training for the Association of Professional Engineers of Nova Scotia

Edmonds, T.
Member of the N.S./P.E.I. Chapter of the Canadian Construction Research Board

Gillis, J.A.
Chairman of Promotion and Publication for Oceans '87 Conference, Halifax, Sept. 28 to Oct. 1, 1987

Hellenbrand, K.
Member of the Board of the Atlantic Institute of Biotechnology

Helliwell, J.
Member of the Economic Development Committee of the Halifax Board of Trade

Council Member of the Nova Scotian Institute of Science

Howells, K.
Councillor, Atlantic Geoscience Society

Jay, D.M.
President of the Nova Scotia Chapter of "WISE" - Women In Science and Engineering

MacAulay, J.D.
Past Chairman, Board of Examiners, Association of Professional Engineers of Nova Scotia

Council Member and Chairman of the Research and Education Committee of the Nova Scotia Institute of Agrologists

Special Lecturer at the Technical University of Nova Scotia

MacNeill, R.
Council Member of the Dartmouth Chamber of Commerce. Chairman of the Public Relations Committee and Editor of the Chamber's publication "Dartmouth Business News"

Marshall J.
Member of the Offshore Trade Association of Nova Scotia Program Committee

Nickerson, T.
Vice-President of the Association of Provincial Research Organizations of Canada Inc.

Chairman of the Applied Microelectronics Institute

Vice-Chairman of the Nova Scotia Council of Applied Science and Technology

Vice-Chairman of the Nova Scotia CAD/CAM Collegium

Selection Committee Member of the Ernest C. Manning Awards Foundation

Chairman of the "InnovatioNS" Newsletter

Vice-Chairman of the Board of Directors of the Discovery Centre

Osborne, J.
Secretary of IEEE Oceanic Engineering Society, Canadian Atlantic Chapter

Helped organize Oceans '87, Halifax, Sept. 28 to Oct. 1, 1987

Prentiss, D.
Treasurer of IEEE Oceanic Engineering Society, Canadian Atlantic Chapter

Helped organize Oceans '87, Halifax, Sept. 28 to Oct. 1, 1987

Roberts, R.
Member of Board of Directors, Haltrans Industries (occupational training for mentally ill)

Robertson, W.
Member of the Dartmouth Lakes Advisory Committee

Spencer, W.W.
Designer of computer-aided dispatch system for Waverley Volunteer Fire Department

Starzomski, J.J.
Nova Scotia Representative on Canada-Japan Coal Liquefaction Working Group

Sutherland, F.
Board Member of the Human Resource Development Association

Special Lecturer and Undergraduate Thesis Supervisor, Technical University of Nova Scotia

Mentor for Engineers-In-Training for the Association of Professional Engineers of Nova Scotia

Tyner, C.R.
Vice-Chairman of the Oceans '87 Conference, Halifax, Sept. 28 to Oct. 1, 1987

Chairman of the Canadian Maritime Section of the Marine Technology Society

Williams, L.
Member of the N.S./P.E.I. Chapter of the Canadian Construction Research Board

Member of the Technical Committee of the Canadian Homebuilders Association of Nova Scotia

AUDITOR'S REPORT

To the Chairman and Members of the
Board of Directors of the Nova Scotia
Research Foundation Corporation

I have examined the consolidated balance sheet of the Nova Scotia Research Foundation Corporation as at March 31, 1988 and the consolidated statements of revenues and expenses and retained earnings for the year then ended. My examination was made in accordance with generally accepted auditing standards, and accordingly included such tests and other procedures as I considered necessary in the circumstances.

In my opinion, these consolidated financial statements present fairly the financial position of the Corporation as at March 31, 1988 and the results of its operations for the year then ended in accordance with the accounting policies stated in Note 2 to the financial statements, applied on a basis consistent with that of the preceding year.

O.P. Cormier, F.C.A.,
Auditor General
Halifax, Nova Scotia
July 8, 1988

Consolidated Balance Sheet
As at March 31, 1988

Assets	**1988**	**1987**
Current		
Cash	$ 875,362	$ 487,972
Accounts receivable	1,203,163	1,126,581
Inventory	215,949	358,723
Work in progress	539,468	208,826
	2,833,942	2,182,102
Research Endowment Fund		
Province of Nova Scotia 9.75% promissory note, maturing November 18, 1988	1,000,000	1,000,000
Fixed		
Land and buildings	2,843,267	2,843,267
Equipment	1,655,379	1,632,784
	4,498,646	4,476,051
	$8,332,588	$7,658,153

Liabilities and Equity	**1988**	**1987**
Current		
Accounts payable		
Trade	$ 343,980	$ 315,414
Province of Nova Scotia	1,908,407	1,168,850
Deferred revenue	92,604	222,018
	2,344,991	1,706,282
Research Endowment Fund		
Fund balance	1,000,000	1,000,000
Equity		
Contributed surplus	4,498,646	4,476,051
Retained earnings	488,951	475,820
	4,987,597	4,951,871
	$8,332,588	$7,658,153

Loan Guarantees (Note 3)

Consolidated Statement of Retained Earnings

For the year ended March 31, 1988

	1988	1987
Balance, beginning of year	$475,820	$498,517
Add: Net income (loss)	13,131	(22,697)
Balance, end of year	$488,951	$475,820

Consolidated Statement of Revenues and Expenses

For the year ended March 31, 1988

	1988	1987
Revenues		
Contracts (Note 4)	$4,001,610	$4,213,852
Grant from Province of Nova Scotia	2,516,900	2,336,000
	6,518,510	6,549,852
Expenses		
Scientific and engineering	5,350,574	5,600,539
Administrative and occupancy	1,322,881	1,162,659
	6,673,455	6,763,198
Operating loss before investment income	154,945	213,346
Investment Income		
Research Endowment Fund	91,286	89,349
Short term investments	76,790	101,300
	168,076	190,649
Net income (loss)	$ 13,131	$ (22,697)

Notes to the Consolidated Financial Statements

March 31, 1988

1. **Authority**

The Nova Scotia Research Foundation Corporation was established in 1975 by the Act to Establish the Nova Scotia Research Foundation Corporation. Its purpose is to assist in the economic development of Nova Scotia by promoting, stimulating and encouraging the effective utilization of science and technology by industry and government.

2. **Accounting Policies**

These financial statements have been prepared in accordance with generally accepted accounting principles modified by the Corporation's accounting treatment of fixed assets described in (c) below.

a) Principles of consolidation: The consolidated financial statements include the accounts of Nova Scotia Magnetics Limited which is 100% owned by the Nova Scotia Research Foundation Corporation.

b) Inventory: Inventory is valued at the lower of cost and net realizable value.

c) Fixed assets and contributed surplus: Fixed assets are acquired by purchase or donation. When fixed assets are acquired out of the general revenues of the Corporation, they are charged to expense in the year of acquisition. The costs of all capital additions, whether by purchase or donation, are recorded as fixed assets with an offsetting credit to contributed surplus. When fixed assets are constructed by the Corporation, the related material, labor and overhead costs are included as fixed assets in the year of expenditure. When equipment is ten years old, the cost is removed from both the fixed asset and contributed surplus accounts.

d) Government assistance: Funds received through the Federal/Provincial Technology Transfer Subsidiary Agreement applied to the acquisition of equipment are offset against the cost of this equipment. Funds received for operating expenses incurred in accordance with the Agreement are recorded as revenue in the same year as the expenses were incurred.

3. **Loan Guarantees**

The Corporation has provided a total guarantee of $50,000 to the Royal Bank of Canada as security for a loan and line of credit from the bank to the Applied Microelectronics Institute. At March 31, 1988, the balance outstanding on the loan was $7,975.

4. **Government Assistance**

Contract revenues include government assistance of $27,846 for expenses incurred under the Federal/Provincial Technology Transfer Subsidiary Agreement.

5. **Reclassification of Prior Year's Figures**

Certain of the prior year's figures have been reclassified to conform to the current year's presentation.

6. **Subsequent Event**

On June 9, 1988 the Board of Directors approved the licensing of the Corporation's rotary products technology to private industry. Management anticipates this will be finalized during the year ending March 31, 1989. In the current year, gross revenues of this product line were $650,000.

ORGANIZATION CHART

BOARD OF DIRECTORS

PRESIDENT & CHAIRMAN OF THE BOARD
T.B. NICKERSON

UNIVERSITY LIAISON DIRECTOR
F.A. SUTHERLAND

APPLIED SCIENCE VICE-PRESIDENT
D.E.T. BIDGOOD

- **Analytical & Environmental Chemistry**
  Director, J.W. Thorpe
- **Coal & Mineral Technology**
  Director, J.J. Starzomski
- **Biology**
  Director, K.E. Hellenbrand
- **Geophysics**
  Director, K. Howells

INDUSTRY SERVICES VICE-PRESIDENT
J.R. HELLIWELL

- **Field Service**
  Director, G.R. Archibald
- **Project Services**
  Director, J.D. MacAulay
- **Materials**
  Manager, H.A. Kazi (Services & Development)
  Manager, T.K. Betancourt (Corrosion)
- **Library**
  Librarian, H.I. Hendry

PRODUCT DEVELOPMENT VICE-PRESIDENT
C.R. TYNER

- **Engineering**
  Director, W.W. Spencer
- **Manufacturing**
  Director, G.H. Channer
- **Marketing**
  Director, J.A. Gillis
- **Quality Control**
  H.G. James

FINANCE & ADMINISTRATION VICE-PRESIDENT
R.F. MacNEILL

- **Accounting**
  Controller, M.J. MacCormick
- **Purchasing**
  Manager, W.G. LeRue
- **Personnel**
  B.J. Oldfield
- **Building Services**
  Manager, G.E. Fraser

BOARD OF DIRECTORS

As at March 31, 1988

***Mr. T.B. Nickerson,**
Chairman of the Board
President
Nova Scotia Research Foundation Corporation
Dartmouth, NS

Dr. J.E. Blanchard
Halifax, NS

Mr. J.C. Callaghan
President
Technical University of Nova Scotia
Halifax, NS

***Mr. M.A. Eisenhauer**
President
ABCO Limited
Lunenburg, NS

***Mr. P. Ferguson**
Operations Manager
Distribution/Atlantic
ESSO Petroleum Canada
Dartmouth, NS

***Dr. W.L. Ford**
Halifax, NS

Mr. W.E. MacLennan
President and General Manager
Farmers Co-operative Dairy Limited
Halifax, NS

Mr. D.H. McKeough
New Glasgow, NS

Dr. J.D. McNiven
Dean, Faculty of Management Studies
Dalhousie University
Halifax, NS

Mr. T.G. Merriam
Deputy Minister
N.S. Department of Industry, Trade & Technology
Halifax, NS

***Mr. W.O. Morrow**
Chairman of the Board
National Sea Products Limited
Halifax, NS

Dr. W.S. Shaw
Chairman, Geology Department
St. Francis Xavier University
Antigonish, NS

Mr. J.E. Terry
Vice-President, Community Services
University College of Cape Breton
Sydney, NS

Mr. R.F. MacNeill
Secretary, Board of Directors
Nova Scotia Research Foundation Corporation
Dartmouth, NS

*Members of the Executive Committee of the Board of Directors

STAFF

As at March 31, 1988

President's Office

President
T.B. Nickerson, B.Eng., M.Sc., P.Eng.

Secretary
N.J. Gerogiannis

University Liaison
F.A. Sutherland, B.Eng., P.Eng.

Finance & Administration

Vice-President, Finance & Administration
R.F. MacNeill, B.Sc., B.Comm.

Personnel Administrator
B.J. Oldfield

Accounting
M.J. MacCormick, B.A., B.Sc., M.B.A., C.A.
E.P. Arsenault, B.Eng., P.Eng.
R. Chaffey
M.L. Creamer

Purchasing
W.G. LeRue
J.M. Foster
E.P. Kelly

Receptionist
J.D. Steeves

Building Services
G.E. Fraser
J.F. Brown
P.S. Mugridge
H.J. Parusel
R.A. Reid
B.S. Gandhu
J.S. Benjamin
G.E. Dean
F.G. Walsh
J.A. Weatherup
D.G. Young

Innovation and Design
P.M. Taiani

Applied Science

Vice-President, Applied Science
D.E.T. Bidgood, B.A., M.A., Ph.D.

Secretarial
J.M. Colpitts
C.A. MacDonald

Analytical and Environmental Chemistry
J.W. Thorpe, B.Sc., M.Sc., Ph.D., M.B.A.
M.J. Firth
W.E. Dearman, B.Sc.
B.P. Boudreau
G.G. Fraser
H.F. Irving
M.J. MacGillivray
P.C. Malley
R.G. Mombourquette
B.J. Reppa
S.G. Thomas

Biology
K.E. Hellenbrand, Ph.D.
A.E. Reade, B.Tech., Ph.D.
C.D. Boyle, B.A., B.Sc., M.Sc.
W.J. Robertson, B.Sc.
H.L. Brown, B.Sc.
K.L. Gunn

Coal and Mineral Technology
J.J. Starzomski, B.Sc.
D.M. Jay, B.Sc., P.Eng.
G.D. Lutwick, B.Sc., M.Sc.,Ph.D
M.A. Peck, B.Sc., B.Eng., P.Eng.
N.S. Stover, B.Sc., M.Sc., P.Eng.
G.R. Johnson, B.Sc.
L.D. Giffin, B.Sc.
D.B. Keeler
M.A. Murphy, B.Sc.
H.J. Peters
R.E. Skinner, B.Sc.
R.W. Tizzard, B.Sc.

Geophysics
K. Howells, B.Sc., Ph.D.
A.G. McKay, B.Sc., M.Sc., Ph.D.
D.D. Prentiss, B.Sc., P.Eng.
D.E. Clarke
R.J. Harris
F.M. Smith
R.E. White

Industry Services

Vice-President, Industry Services
J.R. Helliwell, A.C.S.M., P.Eng.

Secretarial
C.L. O'Connell
G.P. Woodgate

Field Service — IRAP
G.R. Archibald, B.Eng., P.Eng.
J.P. Archibald, B.Sc., B.Eng., P.Eng.
T.K. Edmonds, B.Sc., B.Eng., P.Eng.
I.W. Glass, B.Sc., P.Eng.
J.J. Marshall, B.Eng., P.Eng.
D.W. Martell, B.Eng., P.Eng.
B. Rapson, B.Sc., M.Sc., P.Eng.
J. D. Stacey, B.Eng., P.Eng.
M.W. Veling, B.Sc.
L.M. Williams, B.Eng., P.Eng.

Project Services
J.D. MacAulay, B.S.A., M.Sc., Ph.D., P.Ag., P.Eng.
I.L. Hawboldt, B.Sc., M.Sc.
R.F. Jones, B.Eng., P.Eng.
R.L. Roberts, B.Sc., M.B.A.
K.J. Sibley, B.Sc., M.Sc., P.Eng.
S.L. Lorimer
R. Maxwell

Materials
T.K. Betancourt, B.Eng., M.Eng., P.Eng.
H.A. Kazi, B.Sc.Eng., M.Eng., Ph.D., P.Eng.
J.S. MacIntyre, B.Eng.
M.L. Robicheau, B.Sc., M.Ap.Sc.
W.R. Gillis, B.Sc.
H.B. Stillman, B.Sc.

Library
H.I. Hendry, B.A., B.Lib.Sc.
J.F. Fitch, B.S.A.
M.C. MacDonald, B.A.

Product Development

Vice-President, Product Development
C.R. Tyner, H.N.C., P.Eng.

Secretary
S.M. Williams

Engineering
W.W. Spencer, B.Eng, M.Eng., P.Eng.
N.P. Richter, B.Eng., P.Eng.
E.A. Smallhorn, B.Eng., P.Eng.
J.B. Oliver, B.Sc.

Electronics
J.T. Osborne, B.Sc., A.R.C.S., P.Eng.
C.A. Butler
R.G. Morash, B.Sc.

Drawing Office
W.A. Mills
J. Edwards
N. McFeters

Manufacturing
G.H. Channer, H.N.C., P.Eng.
S.E. Low

Machine Shop
C.E. Isenor
A.B. Johnson
R.J. Conrod
L.R. Hartlen
R.A. Marks
M.A. Wright

Product Assembly
D.K. Julien
G.F. MacPhee

Marketing
J.A. Gillis, B.Sc., B.Ed., M.B.A.
J.P. Cranford

Quality Control
H.G. James

Consultant
D.S. Rankin, B.Sc., Ph.D.